SA 67-018
1 January 1968

MEMORANDUM FOR THE RECORD

SUBJECT: Northeast Electronics Research and Engineering Meeting

1. I attended the subject meeting during 1 through 3 November mainly to sit in on the lectures on satellite communications. The first speaker, Mr. G. R. Frantz of Sylvania compared the development of satellite systems with the comparable development of the TWT and solid-state technology. It was first thought that we would have to stick with low altitude satellites because the cost of a ground station for a synchronous satellite would be very high. Syncom proved the feasibility of synchronous satellites. He recommended against the use of a radome if possible because of the high loss due to rain on the radome surface.

COMSAT is the manager of the Interim Communications Satellite Committee (ICSC) and they expect to have 200 circuits by 1975. They now have nine stations in the pacific and three satellites up with a fourth to go up shortly. This will give global coverage with some overlap. Multiple access will require ground stations specifications to have at least 95 dbw ERP and a G/T at 5° of 40.7 db. Much attention should be paid to station siting in order to stay away from terrestrial microwave possible interference. A ground station costs about $5 million with the antenna going for about $1.2 million, the installation cost about $1 million and the electronics about $1.5 million. The site and preparation take up the rest.

2. Mr. R. A. Latter of the American Telephone & Telegraph Co. recommended a domestic satellite system be integrated into the Bell system. He compared satellites with present long lines technology where the trend is to reduce the costs per circuit mile. Satellites are best for high density circuits between distant stations. He too talked about the importance of locating the ground station in a low interference area which in most cases negate putting the antenna on the roof of the Central Office. Rather it must be located out in the country and a microwave link to relay to the CO. Provision must also be made for alternate routing in case of base station failure. A typical ground station is made to handle 1800 4 kc/s circuits or one TV plus the audio for the program. Fall professional football games have been the big factor in sizing the long lines system since the system must meet the customers requirements. Because of the number of projected TV circuits required he said we should go up above 12 Ghz.

3. Mr. Cal Steinberg filling in for Dr. Perry talked about typical military ground stations. Ranging in size from the AN/SSC 2 & 3 which are 6' dishes up to the FSC-9 a 60 footer with 15', 30' and 40' in between sizes.

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The FSC-9 was originally built for project ADVENT which never did fly but the antenna is now used with the IDCSP program. Military communication by satellites started in the 2 GHz range and has now moved up to the 7 and 8 GHz range. The six foot dishes with 5 kW of power and paramps in the receiver front end provide 1 voice circuit through SYNCOM. The AN/MSC Mark I B is a 40' dish with hermetically sealed and cooled paramps for use with IDCSP. Twelve have been delivered and three more are to go. TACSATCOM, called HS-308 by Hughes, will be able to work into a 1' man pack dish. He talked a bit about the atmosphere absorption problems above 12 GHz. He recommended research in better baseband equipment, random access, adaptive controls for circuit loading and better modems for AJ protection. One of the problems of the military is survivability of their terminals, particularly the small tactical terminals. He estimates antenna sizes for large ground stations would go up to 210' for deep space probes.

4. R. D. Briskman of COMSAT said that as a result of COMSAT studies he proposed a pilot program to give economical multiservice distribution to interconnect with existing ground facilities. It would complement not supplement present systems. An example would be multipoint TV and radio distribution to receive only stations. Four satellites in orbit by 1970 could provide 6 TV programs, by 1980 we would have to go above 10 GHz. He envisioned a system in the mid-1970's which would provide 16 TV plus 4 Educational TV programs and 28,000 message channels. We now have or soon will have 6 large ground stations in the U.S., and eventually we could have 158 ground stations. Satellites in 1978 could provide 24 TV or 19,200 message channels. Using pencil beams the system could provide 50 TV trunks or 75,000 point-to-point message channels. He talked about a 2,000 pound space craft with a despun platform and both North/South and East/West stabilization with a five-year life and estimated a 60% improvement in cost over 10 years.

5. Mr. O. C. Foster of AT&T discussed the problems of siting a ground station so as to minimize interference from other services particularly tropo-scatter stations. There would also be probable interference from adjacent synchronous satellites which once again brought up the frequency allocation problem. He mentioned that even

after a suitable site is found there are often other problems in acquiring the land.

6. In the evening session, Gen. McCormick, Chairman of the Board of COMSAT offered to put $50 million into a multibeam system. He disagreed with the Ford proposal for an ETV which would be paid for by excess income from the commercial broadcasters. He estimated that computer talking to computer in a broadband mode will overrun the narrow band systems. He said 60 nations are already in INTELSAT and they have money in the bank. The technical problems are relatively easy to solve, it is the political nuts which are hard to crack. One of the problems is whether we should diversify and have both cables and satellites, this I believe, was in reference to TAT-5. He brought out that legislation is needed for control of wire and satellite systems.

7. James D. O'Connell, Director of Telecommunications Management pointed out that satellite systems hold great promise for developing nations which do not now have a large internal terrestrial system. In the United States it is just the opposite where satellites replacing all the long lines would only save 20% of the yearly costs. The present U. S. terrestrial systems is an $800 million investment and capacity can be doubled for $50 million which does not make a satellite system look attractive. We need an experimental program to prove the feasibility of domestic satellites systems. We also need international agreements for frequency assignment and space craft positioning. These agreements should help the developing nations. We also should prepare for the renegotiation of INTELSAT in 1969.

8. Dr. K. G. McKay of AT&T said that satellites are large capacity switching systems and their best use is as gateway points to tie into existing ground facilities. Satellites are not good for short haul circuits. He said we should separate our domestic from international satellite systems. He agreed with the COMSAT proposal for an experimental domestic system. He touched on the problems of needing more bandwidth therefore we must go to higher frequencies. We must investigate the rain attenuation problem and try to develop better echo suppression techniques. Two hop voice is not possible now because of the delay involved.

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9. Dr. Whelon, filling in for Dr. Puckett of Hughes, gave essentially the same talk that Dr. Puckett gave at the EIA meeting previously reported in my MFR on that meeting so I will not repeat it here.

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